Introducing Technology to Indigenous Peoples and the Role of Micro-Enterprise
Village Power
December 4, 2000

Notes by Gwen Andersen

The Issues

Grif Thompson

- Village power is no longer a technology issue, it is an issue of institutions. Social and cultural issues are key to getting renewable energy to people within an appropriate context.
- Technology plays a social structure and cultural role.
- Knowing your customer includes knowing his/her culture and values.
- We need more expansive assessment criteria.

Affordability/Income Generation

David Kittelson, NRECA

- Kittelson was recently transferred to Guatemala.
- Rural development combines health, education, and job availability.
- NRECA has begun including a sociologist to determine what people want.
- In Bolivia, NRECA, with the World Bank, did beneficiary assessments that lasted from 6-8 weeks.

Affordability - Two Approaches:

1. Make electricity affordable and they'll all have it
2. Keep electricity at the same price and incomes will increase so that they can afford it.

How to decrease the cost:

- Use Least Cost Technology
- Subsidize through
  - incentives
  - capital
  - operation

Subsidies must exist but "lets optimize the way we subsidize."

NRECA had a project in Bolivia where they charged $0.17/kWh. For their income generation activities they charged 36%. Money lenders charged as much as 500%. Another program in the region charged 48%.

Cost – How Define?

- Cost per unit of electricity (per kWh)
- Cost per unit of light (per lumen)
- Cost for service over time (per month)

Cost per kWh:

- Batteries $50/kWh
- PV $1-3/kWh
- Diesel $0.30/kWh
- Grid $0.07-$0.15/kWh

And associated costs:
- Going to the local store in the nearest town.

Willingness to pay:
- What could he pay?
- What does he pay?
- What could he pay in the future?

"Give away" programs vs. subsidies involve issues of dignity and legal and psychological ownership.

Cultural Impact Sensitivity
Robert Gough, Attorney and anthropologist

Native Americans are calling for renewable energy technologies.
1.4% of all US households are without electricity.
14.2% of reservation households are without electricity.
37% of Navajo households are without electricity.

The boards of the rural cooperatives do not represent the people.

The reservations are now in a position to purchase hydropower directly. They have spectacular wind resources. The Great Plains winds could provide 75% of the electricity used in the contiguous US (DOE). As the grid for hydroelectric distribution expands, Native Americans are thinking of feeding wind into it.

There are questions regarding birds. Even though this is only a problem in one or two sites, in California, certain birds are very important spiritually to the people, and even a few bird deaths will kill the enthusiasm for wind.

The timberline in the mountains is an excellent resource but those sites are necessary as places to go and pray. To maintain their spiritual sanctity they must remain pristine.

Wind has spiritual connotations. We need to learn if we can take its gifts and if so, how would be appropriate?

Tribes need to have legal control over their land in order to keep the above concerns from being "ridden over roughshod."

Renewable energy allows the Native Americans to be leaders again.
Surface ground heat pumps are less objectionable spiritually than direct geothermal.

Gender Considerations
Lisa Büttner

What methods do we use to determine the local needs for which renewable energy is the solution? A participatory process with demand-driven solutions? Or technology driven solutions for a demand we assume exists?

Women and men have different energy needs. Cooking is the primary energy need, requiring firewood and water collection. But rarely are women included in determining priorities in energy planning. One of the limitations to gender inclusion is that men make the decisions at all levels, from national to rural renewable energy and water committees.

Gender roles vary from culture to culture and over time.

Ramifications:
Priorities need to better reflect primary energy needs.
Increased stakeholder participation leads to increased stakeholder ownership.
Then, "solutions" will be more sustainable.

How?

- Demand Assessment
  Work with groups that understand gender analysis. Work with Citizen Based Organizations (CBOs) that know the local languages, cultures, and traditions.

  Project development may require special effort due to cultural constraints.

- Training
  Provide supportive learning environment for women.
  Engage women at all levels, from project design to maintenance, especially as women are the ones who are typically at home with the system all day.

- Credit
  Women have a good repayment record WHEN they have access.

- Promotion
  Women are a powerful market force. Good solutions will sell themselves through the grapevine.

Quality of Service
Art Lily

Quality of service is relative and depends on the user.

Power	**Energy**
Type Voltage Current Reliability Availability	Amount When is it delivered? Comparative cost How used?

Prepayment meters allow families to continue their practice of "spend it if you have it."

Rural consumers use 150 wh/day as an average. It is in the 350-100 wh range. The average expenditure is eight percent of the family income before and after they are electrified. Voltage drop at the end of the grid is two percent.

Previous practice was "schlepping lead." Charging batteries meant shipping it on a bus and going without electricity for one or two days. Now, with CPC, if people have a problem, they go to a service desk, fill out a service request, and the problem is fixed within two days or the customers don't pay.

<u>Don't pay what?</u>
30% pay more than they used to for energy.
40% pay an amount equal to what they used to.
30% pay less.

If you subsidize, do it in a way that does not distort the market. For example, subsidize the capital costs and have people continue to pay for all operating costs, maintenance, and replacement parts. In order to get power to the two billion people without electricity, we need subsidies because the private sector alone is not going to do it.

CPC worked with the local utility to make sure it was abiding by the rules.

Connection fee is a very low 50 pesos.

CPC picked communities where 50% can pay at a rate that provides an acceptable return. That rate is $2/kWh.

Building and Maintaining Local Capacity
Andrew McAllister

Butterflies are an indicator of an ecosystem's health. Batteries are an indicator of a renewable energy system's health. They are old-economy but they are the weak link, the part that fails.

We do not have an adequate model to follow to ensure that these batteries are recollected and recycled. Suppliers participate only at the point of sale. User abuse is due to lack of education and oversight.

The user does not need to understand all the complicated things about the battery, but someone along the line does need to.

The battery tends to be the limiting factor in solar home systems. Lasting 1-5 years, they are a big part of the lifecycle cost.

Training needs to be frequent and sustained. An old system may have new users if new people move into a household.

We need to have systems in place to mitigate the problems with administration. Problems are institutional and, to a certain extent, technical. For example, some controllers are better than others are.

The Experience

Technology Introduction as a Marketing Problem
Phil Covell, Solar Development Foundation, part of the Global Transitions Group (Enersol)

Value of light:
- Quality of life
- Production
- Health
- Literacy

Technology Push vs. Demand Pull
Is Selling vs. Marketing

Determine needs with rapid rural appraisal.

Selling is simply exchanging a product for cash, convincing someone to buy regardless of need. Marketing is developing things that meet the needs of people. It requires listening to people and responding with something of value.

Renewable energy market budgets are small (2%).
We don't take the rural markets seriously.

We are infatuated with technology.
We don't understand marketing principles.
We have not received adequate value from prior market research.

Understanding culture in marketing terminology:
What's important? – salient product attributes
What do the customers yearn for? – perceptual mapping
Decide between values – competing conjoint analysis
How do cultures vary? – market segmentation
How do we offer value? – advance the state of the art

Water

Bob David Foster, Southwest Development Institute, New Mexico State University

- When does water pumping with PV make sense?
- PV water pumping costs $0.20/kWh and allows you to get rid of the batteries.
- There are a lot of diesel and gas based pumps that are grossly oversized. Why? Because it is hard to get small ones.
- With diesel the water is pumped for two hours and someone has to babysit the generator for those two hours. PV pumps all day, unattended.
- PV is competitive up to 1500 meters.

<u>Cleaning water</u>

- Reverse osmosis
  - High maintenance
  - High energy

- UV
  - Simpler tecnology
  - Less effective in the presence of suspended solids > 20 microns in size because bacteria hide under them.

- Mixed oxidants
  - Significant time from the operator who must be trained
  - High energy

- Solar still – evaporation and collection
  In the summer it can produce 7-8 liters per square meter of still.
  In the winter it can produce 2-3.
  These are not very high quantities but the still works for a household. If a household spends $175/yr on water, a solar still pays for itself in less than four years. Still, it is significant upfront capital.

Needs:
Good quality
Low maintenance
simple

www.epsea.org

They have plans for building a solar distiller. They need food grade quality materials.

Telecom
James Casey, telecommunications attorney

Mr. Casey works with Indian tribes in the US. Providing telecommunications is very complex and very expensive, ranging from hundreds of thousands to millions of dollars.

Basic Principles
Why do you want it?
- People want the internet
- FCC had assumed it was for safety

Because people want the internet, cellular is inadequate.

Seven tribal entities have bought out their telecommunications companies. The companies had been providing lousy service. The Salt River Tribe, outside of Scottsdale, AZ, built a high powered telecommunications system capable of serving 2-4000 people. The tribe has 200 people. The tribe sells excess capacity and uses the revenue to subsidize on-reservation operations.

1. Turn your thinking around
2. Partnerships – if you don't understand the culture, you'll get it wrong.

Health Clinics/Refrigeration
Ken Olson
- PV used for conservation of vaccine both in transit and after it has arrived at the clinic.
- The logistics for kerosene are very difficult. Using kerosene to control refrigerator temperature is very difficult.
- With solar, the problem is distribution of skills to take care of it. Using solar on a national basis is a management problem.
- The WHO has concluded that rural energy is critical to improved health and that solar is a big part of the solution.

- Health applications:
  - Vaccine refrigeration
  - Ice pack freezing
  - Lighting
  - Communication
  - Medical appliances
  - Sterilization
  - Water supply and purification
  - Lifestyle amenities for staff
  - Income generation

- Health programs are donor driven. As a result there is poor service infrastructure, lack of operating funds and poor management.
- Vaccine refrigeration needs stable temperature control to within 2-8 degrees Centigrade. Icepack freezing, on average, only requires 0.5 kWh/day. 150-225 watts can do it.
- WHO supports programs in Honduras, Nicaragua, Guatemala, and Peru.

Roles
- Decision makers
- management
- service/technicians
- users
- community

Management
- Policy guidelines
- Procurement procedures
- deployment
- quality control/evaluation
- knowledge/skills
- operational funds – are there funds for new batteries? If the battery is supposed to last five years but dies in one, can they get another one?

Procurement
- Ill-defined standards
- Designs from donors are not always appropriate, creates black eyes for the technology
- one-size-fits-all designs
- Inadequate resource data
- Incompatible equipment ex. controller for specific type of battery, later the clinic will use different kinds of batteries
- Inadequate documentation, from nothing at all to engineering texts, or in English

Personnel need frequent training. People leave. There are new equipment variations.

How do you handle the use of five different designs? You must keep records of what system is in use where and what maintenance is done, where.

“Pay for services” doesn’t work in health care.
The Dutch donated health system and video equipment and a battery charging station. They charge money for videos or battery charging. That money supported the PV system costs.

Australia

Bruce Walker, Director of the Center for Appropriate Technology

- The average size of the aboriginal community is 170 people. There is a social safety net, but the community has no income generation.
- The people have a spiritual need to live on their land.
- Accepting a new technology makes one dependent on outsiders. Will the outsiders be there in ten years?

Dominican Republic

André Verani, Director of Enersol

- Richard Hansen had been with Westinghouse. He went to the Dominican Republic to do renewable energy 16 years ago.
- Enersol is branching out into the community with water delivery projects (Aquasol) and information technology.
- Aquasol water projects use existing solar technicians. They participate in the installation and are contracted to do the maintenance.
- The work is on cost recovery. The project really begins when the equipment is installed. They are looking at metering water delivery. People would pay for the water they consume. This payment would go into a water maintenance fund.
- EduSol provides computers and educational CD-Roms, all powered with PV.
- Lessons:
  Don't electrify their villages. Help them electrify their communities. It requires cross cultural skills and the ability to get across the linguistic barrier.

Native Americans

Debby Tewa

- From Northern Arizona, Hopi reservation. The people live in quarried rock houses.
- Ms. Tewa used to run Native Sun. She lives in a village with 75 systems so even though she does not run Native Sun anymore, people come to her with solar problems because she is close. Tewa used a lot of Trace products.

Nepal

Jagan Nath Shresta, Nepal Solar Energy Society

- 96% of the people in the rural areas do not have access to electricity.
- White light emitting diodes (LED) use almost no power. They are calling it the "kerosene killer." They use DC and low voltage.

Models for Microenterprise

Grameen Bank

Dipal Barua

- They use no subsidies.
- Their systems are 50 Wp panels, 100 AH batteries. A system can power a cell phone for 18 hours per day.
- They've reduced the blackening problem with the use of fluorescent lamps.

CPC
Robb Walt

Alaminos is 300 miles south of Manila. It has a small coconut oil mill. The town also uses coconuts to make soap, geotextiles, coir nets, and pina cloth. Alaminos is on the grid but the power was down 2-3 days a week.

Alaminos had a lot of waste coconuts that could be used as biomass thanks to the coconut oil mill. For US$10,000 they could increase their operation to a profitable/sustainable level.

Pearl Amanapole (sp?) works for CPC in the Philippines. She made an arrangement with the Boracay hotels, an hour away, to purchase soap from the community.

The rural electricity cooperative with the franchise in this area was exceptionally supportive of the idea. The chair whose approval was needed was delighted to approve because he was coming up for election.

Selco India
Harish Hande

Selco India uses the rural banks and charges commercial interest (36-40%). They piggyback off of the existing financial network of the country to make systems accessible to customers.

Key to marketing:
- financing at the customer's doorstep
- after sales service at the customer's doorstep

They hired local entrepreneurs who spoke the local accent.

The defaulters are in urban areas, not rural ones.

It was initially difficult to get the banks to finance solar systems. They were only ready to finance income generation activities. Selco India convinced them to finance solar systems by bringing in a group of silk weavers who could weave more with more lit hours. They argued that the solar lighting system was an investment in future income as well, by allowing the children to study at night. Once Selco India convinced one bank branch, they had no more problems with other branches.

Their banks lend with terms up to five years.

Greenstar
Charles Gay

Greenstar sets up solar internet systems in isolated rural villages. They use wireless radio modems with a speed of 1 MB per second. These systems provide

- public health resource.
- water supply
- video/entertainment

Banks want to put ATMs in the centers. Fertilizer companies want to do outreach from them.

All of these activities together can defray up to 80% of the initial capital.

The most innovative aspect of these systems is that they allow the community to share its culture with the world. Their music can be recorded, digitized, and sold through the internet. World music is 12% of the market now, the fastest growing segment. Paintings or drawings can be scanned and sold through the internet as downloadable files or ordered as posters.